

## IMPACT OF GREEN PRODUCTION AND GREEN TECHNOLOGY ON SUSTAINABILITY: CASES ON COMPANIES IN INDIA

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### ABSTRACT

*This research aims to examine the impact of Green Production and Green Technology on environmental sustainability with the help of cases on Indian companies which are doing a commendable work by constant research and development in the field of Production Engineering. The companies selected for the research are WIPRO, TCS, Tech Mahindra Ltd., Essar Oil Ltd and Larsen and Toubro Ltd. These companies are among the global leaders in green manufacturing technology and they have achieved the positions in CDP Climate Disclosure Leadership Index. By applying the techniques of Green Marketing in production and technology, these companies have achieved and contributed a great deal. What all they have done and what all they have achieved with the help of green production and technology is the prime focus of this research.*

**KEYWORDS:** Green Production, Green Technology, Manufacturing, Green Engineering, Indian Companies & Green Marketing

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### INTRODUCTION

Many international or national firms belonging to various fields and different product lines are engaged in changed behaviour and practising green marketing (Nadaf & Nadaf, 2014). According to Nadaf & Nadaf (2014) this is the time of non-toxic, biodegradable and green products. Marketers can make the best use of this mantra. The old production and consumption pattern has brought many problems along with prosperity (IRACST, 2016). The problems like pollution, ozone depletion, water contamination, various diseases and depletion of the natural resources. The more the present generation consume, the less is there for future generation to consume. There is a strong need for sustainable consumption and sustainable production.

### GREEN PRODUCTION AND TECHNOLOGICAL INITIATIVES TAKEN BY COMPANIES IN INDIA: CASE STUDIES

#### WIPRO- Information Technology Company

##### Introduction and Brief

Wipro also known as 'Western India Palm Refined Oils Limited' or 'Western India Product Limited' is an information technology company. The company started as a vegetable and refined oil manufacturer. After the death of M.H. Premji in 1966, Azim Premji (his son) returned from Stanford took over the business as a chairman. During the years of 1970's and 1980's, the company started to shift its focus to IT services. In 1977, the name of the company is changed to Wipro Products Limited from Western India Vegetable Products Limited. In 1982, the

name was changed again to Wipro Limited when the company marked its presence in IT domain. It became the first software and information technology company in India to get the ISO certification in 2002. In 2012 company demerged and consumer care, furniture, lighting and infrastructure engineering were named as Wipro Enterprises Ltd. In 2008, it entered into clean energy business and named it Wipro Eco Energy.

### **Green Production and Technological Initiatives at WIPRO**

The Green Initiatives taken by Wipro are mentioned in their Sustainability Report 2015-16. The following are the initiatives taken by Wipro for Ecological Sustainability:

- **Energy and GHG Emissions**

- Pilot rooftop Solar PV installations at 3 Wipro Campuses. They use solar water heaters in cafes and guest blocks which saves up to 1.3 Mn Units of electricity.
- They run 2088 virtual servers on 147 physical servers which saves up to 9 Mn units of energy.
- A Co2 emission from Indian office spaces is 116 kg Co2 eq. per sq. mt. which is 10.8% less than previous year.
- There has been a decrease of 5% in the absolute Scope 1 and Scope 2 emissions.

### **GHG Mitigation Leads to-**

- Energy Efficiency
- Captive RE
- Purchase of Renewable Energy
- **Waste Management**
  - 92% of the waste generated at Wipro is recycled or reused. Their target is to handle 100% of the organic waste in-house on all of their locations.
  - Wipro segregate degradable and non-degradable waste and then send it to technically sound waste disposal agencies for degradation process.
  - Waste from canteen food is converted into biogas and used as a fuel which saves up to 100 tons of GHG annually.
  - Bio gas plants are currently operational at 3 locations and designed for 3 more.
- **Water Management**
  - Wipro recycled 32% of their water used in 2015-16.
  - 4.8% reduction in per employee water consumption. It reduced from 1.36 m3 to 1.295 m3 in previous year.
  - The percentage of recycled water as a percentage of freshwater is 52%.
  - 2% of the freshwater comes from rainwater harvesting.
  - Wipro participate in PGWM (Participatory Ground Water Mapping Program) with an aim to create a participatory community centre approach.
  - Wipro is aimed to develop an understanding of aquifers in urban context watershed.

- **Biodiversity**

- To make their 5 campuses biodiversity zones by 2017.
- Biodiversity principles will be incorporated into the designs of all new campuses.
- Completed their first phase of Butterfly Park. Next phase includes making a wetland with the help of recycled water.
- Two Pune campuses have been converted into biodiversity zones with five different types of gardens: spring garden, spice and fruit garden, ficus garden and aesthetic and palm garden.

- **Customer Stewardship**



Source: Wipro Sustainability Report 2015-16.

Figure 1

- Through their Energy Management services engagements, consumers have saved up to 800 Mn KW of energy which is equivalent to: 4,40,000 Metric tonnes of Co2 emissions, 1,60,000 cars taken off the roads, 80,000 homes get electricity and 1,60,00,000 saplings planted.
- **Supplier Sustainability**
  - Wipro makes ensure and expects their suppliers to supply goods and services that adhere to environmental standards.
  - It expects their suppliers to adopt environmental sustainability in their own programs and operations.
  - 75% of supplier base is from India which accounts for 66% by procurement value.

Wipro in all the countries adheres to strict regulatory compliance. Before starting any new facility it gets the clearance from Pollution Control Board and does Environmental Impact Assessment. It complies with all the environmental regulations and policies.

### **Achievements**

The sustainability effort by Wipro has won it some great awards and accolades. The company has won several awards from many consecutive years. The lists below show the achievements of the company:

- Wipro is passionate about transparency in disclosures. 8 sustainability reports have been published by the company till date with full disclosures of their actions and steps taken to find remedies of those actions.
- The company became the member of the Dow Jones Sustainability Indices for the fifth year in a row.
- CDP Climate Disclosure Leader 2015 recognized Wipro as World Leader for corporate action on climate change.
- Confederation of Indian Industries (CII) bestowed Wipro with ‘Sustainability Plus’, the world’s first Corporate Sustainability Label.
- Wipro is certified as “Best in Class” in five areas: Leadership, Ethics, People, Community and Environment.
- Wipro is also a member of ‘Global Sustainability’ index series.
- It is awarded the Ecovadis- Supplier Sustainability Ratings.
- Top position by Greenpeace’s latest green electronics ranking.
- Newsweek Green Ratings has given Wipro a second spot on worldwide level.

### **Tata Consultancy Services**

#### **Introduction and Brief**

Tata Consultancy Services is an Indian company providing IT, consulting and business solutions all over the world. TCS was established by a division of Tata Sons Ltd. in 1968. It operates in 46 countries globally. It is one of the largest companies by market capitalization. Worldwide, TCS is among the ‘Big 4’ most valuable IT services firm and was ranked 64<sup>th</sup> by the Forbes in the World’s Most Innovative Companies Ranking in 2015. It makes TCS the highest ranked IT company and top most company in India as well. In 2015, it is on 10<sup>th</sup> spot of Fortune India 500 list.

It has 289 offices in 46 countries and 58 subsidiary of its own. It has done multiple mergers since 2001 till date among which are some as huge as \$512 Million. TCS alone generates 70% dividend of Tata Sons. In India, it is the fourth largest employer after Indian Railways, Indian Army and India Post and largest in private sector.

#### **Green Production and Technological Initiatives at TCS**

##### **Green Building (A TCS Initiative)**

A delivery centre of TCS in Bhubaneshwar is India’s first LEED certified IT campus. TCS Kalinga Park got the highest ratings (Platinum) from Leadership in Energy and Environment Design (LEED). LEED is a rating agency created by US Green Building Council which gives ratings to environmentally sustainable constructions. It was built by Orissa Infrastructure Development Corporation which spread across 45 acres with 50% green area.

In the first phase, it has a capacity of 1002 and by the end of second and third phase, it will have seat for 7000 associates. In the LEED assessment, the campus scored 56 out of 69 which is highest. The building has been designed to cut down energy consumption in all the facilities like ventilation, heating and AC. Building management systems and energy modelling shows a 32% reduction in energy consumption.

It is awarded a title of 'Green Building' because it reduces and eliminates the damaging impact of building on the environment. Five broad areas were considered which have an impact on the environment i.e. material use, water management, site planning, energy and indoor environmental quality. The following are the green features of TCS Kalinga Park campus:

- Water harvesting and recharging
- Use of renewable contents
- Use of low CO<sub>2</sub> emitting materials and contents
- Use of local and regional materials
- For energy conservation use of high efficiency chillers
- Controllable comfort system based on variable air volume
- Controllable lighting system
- Use of grey water in toilets and landscaping
- On-site generation of renewable energy
- Thermal paints and insulators

Strategic Development Model at TCS integrally includes reduction of carbon footprints as their main priorities. TCS Kalinga Park is standing on its commitment through their Green Building Initiative.

- **Energy and GHG Emissions**

- A GHG emission from Scope 1 and Scope 2 sources combined was 1.69 tCO<sub>2</sub>e/FTE which is 7% less than previous year i.e. 1.82 tCO<sub>2</sub>e/FTE. It is 43.6% less than the base year of 2008.
- There is 45% reduction in electricity consumption.
- 43.6% decrease in carbon footprint.
- Got LEED certification for 10 campuses
- 3.1% of total power is generated from renewable sources
- Business air travel emissions are reduced by 50%
- Across 23 key data centres TCS achieved a power usage effectiveness of 1.75
- Target to reduce their specific carbon footprint by 50% by 2020.

- **Waste Management**
  - TCS has a target of achieving zero waste to landfills by 2020.
  - 100% of e-waste from TCS is recycled through government authorised recyclers.
  - 100% of their hazardous waste like lead acid batteries and waste lube oil is also recycled through government authorized recyclers.
  - 31% of biodegradable waste is recycled.
  - 100% of paper waste from TCS is properly recycled.
  - There is a reduction of 80% in specific paper consumption.
  - Under product take back arrangement, printers and their cartridges are sent back to manufacturers.
  - All the garden waste is sent for Vermi-composting.
  - Food waste is sent to generate Biogas.
- **Water Management**
  - TCS has a target to achieve water neutrality by 2020.
  - 100% recycling and treatment of sewage water.
  - TCS has built a rainwater harvesting capacity of 478,626 cm.
  - 15% decrease in specific water consumption from the baseline year of 2008.
  - 5.54 million KL of water recycled.
  - 13% reduction in water consumption.
- **Biodiversity Conservation**
  - TCS campuses are a home to 127 fauna species and 305 flora species.
  - Few rare breeds of plants like camphor, rudraksha, red sandalwood and sandalwood can be found inside the TCS campuses.
  - TCS carry out biodiversity mapping and protect the rich biodiversity through various CSR programs.
- **Supply Chain Management**
  - Aim to conduct vendor sustainability assessment.
  - Desktop review of each vendor.
  - TCS studies each vendor's landscape and does the risk assessment.
  - Supplier Code of Conduct and HSE requirements are included in the contracts with the vendors and suppliers.

## ACHIEVEMENTS

The green initiatives taken by TCS have won it many accolades some of which are worth mentioning here:

- Carbon Disclosure Leadership Index 2015 has given TCS a perfect score of 100 and the company is included in the list of Global Leaders in Climate Change for the fourth year in a row.
- TCS Deccan Park campus at Hyderabad has won a CII National Award for Excellence in Energy Management.
- In the Conference on Sustainability and Inclusive Development TCS won CII (Western Region) Best Practices case study Award 2015 in Waste Management.
- World CSR Day Organization gives TCS 'India Sustainability Leadership Award 2015' in the area of Sustainable Carbon Management category.

## **Tech Mahindra Limited**

### **Introduction and Brief**

Tech Mahindra Ltd. is an Indian Information technology company working on global scale. Tech Mahindra is a part of Mahindra Group providing IT services like networking technology solutions and BPO to telecom industry. It is active in 90 countries with over 117,600 employees. It is ranked at number 5 in India in IT services and overall at 111 in 2012 by Fortune India 500. It started as a joint venture with British Telecom in 1986. But with the passing time British telecom sold its share and now has existed from the Tech Mahindra company. Tech Mahindra acquire Satyam Computers bidding an offer of Rs. 58.90 a share beating Larsen and Toubro and marked the largest merger in the India's Tech Industry. It bought the company twice its size in terms of number of people.

Tech Mahindra has a number of mergers and acquisitions to its credit till date and which established its offices in more than 60 countries around the world. Since its incorporation, the company has shown tremendous growth in less time as compared to its rival in the industry. It has been not a much time since it is born and it is competing edge to edge with the big groups in IT sector. And this tremendous performance has led this company to be in the list of global leaders in terms of overall sustainability.

### **Green Production and Technological Initiative at Tech Mahindra**

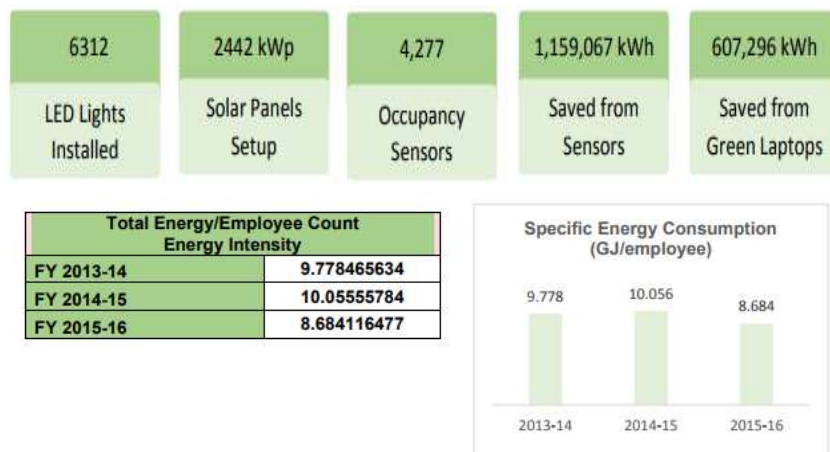
In its Corporate Sustainability Report 2015-16, the company has mentioned that there was no single grievance was filled against the company on environmental impacts.

- **Green Marshals- The Environmental Warriors**

The Green Marshals are the passionate employees of the company who are eager to work towards the environmental sustainability and reduction of carbon footprint. This initiative involves the active participation of associates and employees of the company. These Green Marshals makes the following initiatives successful:

- Planting more and more trees which require less water.
- Providing cycles to commute within the campus.
- Getting associates participate in green quizzes, green rangolis, cycle races etc. to create awareness about the green practices.
- Promoting Carpooling through the initiatives such as 'Drive with a Leader' and 'Ride for Pride'.
- Segregation of waste in to biodegradable and non-degradable.
- Use of more digital technology so that paper can be saved.
- Campuses with no occupancy sensors implement weekly 'light off'.

- Food waste tuned it to composting.
- Workshops for showing eco-friendly products, organic farming and how to do home composting.
- Introducing waterless car wash.
- **Energy Management**
  - Use of Occupancy sensors
  - Server virtualization
  - Green procurement of laptops
  - Procurement of energy efficient lighting
  - Setup of solar modules
  - Installation of wind turbines
  - Installation of solar water heaters.



Source: <http://www.techmahindra.com/en-US/www/Company/Documents/Tech-Mahindra-Sustainability-Report-2015-16.pdf>

Figure 2

- **GHG Emissions**
  - The Solar Plant Capacity is 1928 KWp making the renewable total capacity of 2442 KWp.
  - Adoption of virtual meetings so that travel emissions can be reduced.
  - Encourage employees to use carpool technique to commute.
  - The savings from reduction in emissions are:



Source: <http://www.techmahindra.com/en-US/www/Company/Documents/Tech-Mahindra-Sustainability-Report-2015-16.pdf>

Figure 3



- Huge investments have been made in solar water plants at different locations.

**Table 1**

<b>Solar plants commissioned</b>	
<b>Location</b>	<b>Investments INR Cr</b>
Pune Hinjewadi	1.65
TMCC - Chennai	7.16
TMIC SEZ - Hyderabad	1.54
TMLW - Hyderabad	1.36
TMIC - Hyderabad	0.6
TMTC - Hyderabad	4.18
<b>Total</b>	<b>16.49</b>

Source: <http://www.techmahindra.com/en-US/www/Company/Documents/Tech-Mahindra-Sustainability-Report-2015-16.pdf>

- **Water Management**

- Tech Mahindra has Sewage Treatment Plants at all of its campuses.
- All waste water is recycled and is reused within the campus.
- With the help of STPs Tech Mahindra has zero discharge facilities.
- The company do not affect any water source due to water withdrawal.
- Has rainwater harvesting in the campuses.
- Continuous tracking of consumption of water.
- Encouraging water conservation techniques.
- Specific Water Consumption has been reduced from the previous year

- **Waste Management**

- Hazardous waste has been handled as per the rules by the Central and State Government.
- 100% hazardous waste is handled through government authorized agencies.
- All the organic waste has been composting.
- Horticulture activities use this decomposed waste as manure.
- No organic waste goes to landfills.

- **Biodiversity Management**

- None of the Tech Mahindra Campuses are near the rich bio diverse areas or areas which are protected.
- Sawn pond was set up Hinjewadi Campus at Pune.
- 4,414 plant saplings were planted.

- The campus has different species of plants, trees and shrubs which help control the climate of the area.

### **Achievements**

The company has many awards and recognitions because of the initiatives taken in the field of environment. Accolades won in the field of environment and sustainability is as follows:

- It is awarded the Silver Class Distinction the Dow Jones Sustainability Index Yearbook 2017.
- Recognized as CDP Global Supplier A List 2017.
- It is one of the 3 Indian Companies to be in the list of DJSI 2016.
- CDP has given rating 'A' to Tech Mahindra making it to the list of Global Leaders in Climate change for 2016.
- CII Sustainable Plus gave Tech Mahindra Gold rating.
- It is among the 10 companies in the list of DJSI Emerging Markets for 2016.
- Awarded the Skoch Order-of-Merit for innovation.

### **Essar Oil Limited**

#### **Introduction and Brief**

Essar Oil is an Indian company providing services in Oil and Gas Industry. It is a subsidiary of Essar Group. Essar Oil is working in the field of extraction and production of oil and natural gas, marketing of petroleum products and refining of crude oil. It has a major refinery in Vadinar, Gujrat, India which is the second largest non-state refinery in India. It is a public limited company whose shares are listed in NSE and BSE. In 2016, the Russian based oil company Rosneft bought a stake of 98% in Essar Oil. The parent company of Essar Oil is Essar Energy.

#### **Green Production and Technological Initiatives at ESSAR OIL**

Sustainable development is an integral part of Essar. It focuses on three areas of sustainability i.e. economic, social and environmental.

- **Energy Management**
  - Implementation of ISO 50001:2011 at Vadinar refinery in Gujarat.
  - It involves top management to bottom management.
  - Training and awareness programs for contractors and employees.
  - Energy policy was framed and released by the management.
  - Internal auditors were trained to implement EMS.
  - The benefits of adopting EMS: efficiency, cost saving, energy saving and reduction in emissions.
- **GHG Emissions**
  - CBM Gas is extracted from Raniganj Coal field in West Bengal.
  - The company is replacing diesel generators with CBM gas generators.

- Coal-bed Methane Gas is known to reduce CO<sub>2</sub> emissions.
- Now, at the site 17 diesel and 30 CBM gas generators are used.
- This has reduced the CO<sub>2</sub> footprint by over 50%.
- The emissions have dropped from 60 MT/day to 25 MT/day.
- Annually this has reduced CO<sub>2</sub> emissions of 12,775 MT.
- **Water Initiatives**
  - It uses produced water for different uses. Produced water is water which is trapped in underground formation and has a long term contact with hydro-carbon bearing formation and so it does have some of the chemical properties of it.
  - At Raniganj Project, the reverse osmosis plant is installed to treat this produced water.
  - This treated water is used for CBM Processes like workover, hydro fracturing and drilling.
  - This saves large quantities of fresh water.
  - 332,584 cms produced water was treated last year and put to different uses at the site.
- **Energy Saving Opportunities**
  - Four projects ranging from operational change to process change were implemented which saves 18224085 KWh of energy.
  - One of the project was to reroute the light gas oil pump around in order to increase the crude preheat temperature which alone saves the energy of 2093400 KWh.
  - Another project resulted in the saving of 76464 KWh i.e. 18 KW per hour.
  - Use of natural gas instead of fuel oil at 77 MW power plant at Essar Oil India.
  - In refinery furnace operations, natural gas is being used in place of fuel oil.

### **Achievements**

Though this sector is among the highest emissions producing sector, still the company has won many accolades to its name.

- CDP awarded Essar Carbon Disclosure Leadership Index in Carbon Management.
- Skoch Renaissance Awards recognised Essar in Gold category in the field of Environment and HR.
- OISD, Ministry of Petroleum and Natural Gas awarded Best 'Near miss incident' reporting refinery award for the year.
- Indian Chemical Council awarded Excellence in energy conservation and management.
- Ministry of Petroleum and Natural Gas gave the second prize in refinery energy performance.

## **Larsen and Toubro Limited**

### **Introduction and Brief**

Larsen and Toubro Ltd. is also known as L&T which is an Indian conglomerate company established in Mumbai. L&T was established by two Danish refugees Henning Holck Larsen and Soren Kristian Toubro in 1938 in London. In 1947, after India's independence the company set up offices in New Delhi, Chennai and Kolkata. In 1950, it became the public company with a paid-up capital of 20 lakhs.

The company has a business in manufacturing goods, construction, information technology, engineering and financial services. The company has its own 130 subsidiaries and 15 associate companies. It has offices worldwide and has over 1,00,000 employees. It has number of operating divisions like L&T Realty, L&T Technology Services, L&T Solar, Electrical and Automation, Information Technology, Machinery and Industrial products and EWAC Alloys Limited.

### **Green Production and Technological Initiatives at L&T**

The company has done tremendous efforts in the field of Environmental Sustainability. It has launched various missions in view of sustainability.

- **Mission 1: Solar Energy**
  - 567 MW of solar energy has been installed for clients.
  - At Panaiyur Village, the largest solar tracker system was installed with two 60 MWp tracker solar PV plants.
  - 18 L&T campuses are producing their own solar energy for campus usage.
  - Solar projects are executed across all terrains and technologies.
  - It is a channel partner with Ministry of New and Renewable Energy.
- **Mission 2: Energy Efficiency Enhancement**
  - Hired more than 20 certified energy auditors for various campuses and locations.
  - Implementation of ISO 50001:2000 EMS at Hazira, Pithampur, Ahmadnagar, Kancheepuram and Pondicherry campuses.
  - In the last 8 years, more than 60916 tCO<sub>2</sub> emissions have been avoided by saving more than 76 Million units of energy.
  - Electrical and automation business with the help of their products and services reduce carbon footprints of their customers.
- **Sustainable Habitat**
  - 17 Green Buildings have been established by the company within its various campuses and one green factory at Vadodara.
  - USGBC and IGBC have rated the company's buildings as: 6 Platinum, 6 Gold, 4 silver and 1 certified.
  - 49.1 Mn Sq. ft. Of certified green space has been constructed by L&T for its clients.

- The latest addition to the green building is the Technology Centre at Powai.
- **Mission 4: Water Conservation**
  - At 28 L&T campuses, there is no discharge of waste water.
  - In total of 8 campuses have 'Water Positive' status.
  - With respect to 2011-12, there has been 12.20% of reduction in water consumption.
  - 200 check dams have been built by L&T.
  - More than 80Mn Litres of water storage capacity is built by L&T in water stressed areas.
  - L&T is India's largest water infrastructure organization with more than 4000 MLD water treatment plants and construction of 51000 Km of water pipelines.
- **Mission 5: Strengthening the Himalayan Ecosystem**
  - Large scale tree plantation in and around Himalayan region has been executed.
  - Skill building programs are executed for the youth in the region to enhance their employability.
- **Mission 6: Green India**
  - More than 35% of the campuses' space is under green.
  - More 150000 trees have been planted at L&T campuses.
  - In the last five years more than 1.5 million trees have been planted.
  - Felicitation of the guests is done by planting a tree or gifting them a tree certificate.
  - Integrated Community Development project includes tree plantation and maintenance across villages in Rajasthan, Tamil Nadu and Maharashtra.
- **Mission 7: Sustainable Agriculture**
  - 200 check dam construction has helped number of farmers in the irrigation.
  - Water and Effluent Treatment has helped in the rehabilitation of canals and irrigation system.
  - The Electrical and Automation business helps the agriculture sector by providing range of products and services for electricity distribution and control.
  - Solar pumps are provided to farmers to reduce their dependency on conventional pumps.
  - Increasing availability of water in water stressed areas.
- **Mission 8: Strategic knowledge on Climate Change**
  - Arrange capacity building programs on climate change and green initiatives for employees.
  - Conduct CII- GBC certified programs on climate change and sustainability.

- Green Building rating programs.
- Training program on the GreenCo rating system for companies.
- A case study on climate change and energy was showcased at the 2015 Paris Climate Conference as the 'energy efficiency and Climate leaders'.

### Achievements

L&T has the number of achievements on its name and has won number of awards and recognitions.

- Best Practice award for Sustainable Development Goals for 2017 by United Nations Global Compact.
- L&T's Sustainability Report has won Asia-Pacific Excellence Award.
- Dow Jones Sustainability Index 2016 listed L&T in the top 15 leaders in the Construction and Engineering sector.
- It is the only company from India that retained its position in the DJSI- Emerging Markets Index in capital goods category in 2016.
- In 2015 as well the company was in the list of DJSI- EMI in capital goods category.

### CONCLUSIONS

It is evident from the above case studies that green production and green technology has helped in achieving a lot than just saving money. It helps in resources conservation, reduction in pollution, saving of energy and materials. These companies have used the combination of green manufacturing technology, engineering science and marketing management concepts to become the world leaders in environmental sustainability. They have used the production engineering a best way to make this planet a better place to live for present and future generations to come.

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